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The spotted crake, *Porzana porzana* (L.) (Rallidae, Aves), from a Bavarian Eem interglacial lake deposit

Ein Tüpfelsumpfhuhn, *Porzana porzana* (L.) (Rallidae, Aves), aus Seeablagerungen des Eem-Interglazials in Bayern

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With 2 text figures and plate 1

Summary

A well-preserved, incomplete skeleton of *Porzana porzana* (Rallidae, Aves) was recovered from an Eemian marl deposit at Friesing (Samerberg), southern Bavaria, W. Germany. The specimen is described, and a review is given of known localities yielding *Porzana porzana* remains. It appears that the longevity of this species does not surpass that hypothesized for the majority of Quaternary bird species. Thus no *Porzana porzana* remains are known from pre-Quaternary deposits, and those among the Pleistocene specimens which have been referred to in more detail belong to the Würmian stage. Another German *Porzana porzana* find, from the postglacial Meiendorf locality close to Hamburg, is discussed.

Zusammenfassung

Ein gut erhaltenes, unvollständiges Skelett von *Porzana porzana* (Rallidae, Aves) wurde in eemzeitlichen Seetonen bei Friesing (Samerberg), Oberbayern, entdeckt. Das Exemplar wird beschrieben, und es wird ein Überblick über die bekannten Fundorte von *Porzana porzana* gegeben. Offenbar überschreitet diese Art nicht die für die meisten quartären Vogelarten hypothetisch angenommene Lebensdauer. So sind keine Reste von *Porzana porzana* aus präquartären Ablagerungen bekannt, und diejenigen pleistozänen Funde, die mehr im Detail mit dieser Art in Beziehungen gebracht wurden, sind würmeiszeitlich. Ein weiterer deutscher Fund von *Porzana porzana* aus dem Postglazial von Meiendorf bei Hamburg wird diskutiert.

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Introduction

The fossil bird described here and referred to the species *Porzana porzana* (family Rallidae) was recovered from a lacustrine marl deposit of the Gernmühler Becken, a small depression of the Samerberg valley in southernmost Bavaria. The formation of the gross morphology of the Samerberg area is attributed to the Quaternary glaciations ; thus the Samerberg valley is described (P r ö b s t l , 1972, p. 65) as „ein richtiger Daumenabdruck des Inneises", a glacier tongue which coming from the Alps followed the course of the present Inn river. The specimen, which became deposited during the warm interval between the two latest glaciations, is so far the only recorded spotted crake from Bavarian, and also from German Pleistocene deposits.

Leaving aside the famous five *Archaeopteryx* specimens from the Upper Jurassic Solnhofen lithographic limestone, the majority of known Bavarian bird fossils derive from fissure fillings in Jurassic limestone rocks of the Fränkische Alb (particularly of its southern part), these bird fossils being for the larger part of Tertiary age (D e h m , 1961; B a l l m a n n , 1969).

The Eemian *Porzana porzana* belongs, as No. 1973 I 59, to the Bayerische Staatssammlung für Paläontologie und historische Geologie in München. The writer here wants to express her gratitude to Dr. P e t e r W e l l n h o f e r , curator of the collection, for conveying the specimen to her for investigation and description.

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T a b l e 1. Chemical analysis of matrix (finegrained lake sediment) of the Eemian *Porzana porzana* remains:

Percentage by weight of dry matter:	
Insoluble + SiO_2	24,9
Fe_2O_3	2,4
Al_2O_3	2,1
TiO_2	0,06
P_2O_5	0,20
CaO	32,7
MgO	2,39
MnO	0,041
Na_2O	0,35
K_2O	0,33
CO_2	26,6
Loss on ignition 1000° C ÷ CO_2	7,2

The chemical analysis has been made by senior-geologist H. Kristiansen (Geological Survey of Denmark) on components soluble after 2 hrs' boiling with aqua regia (1/3 HNO_3 + 2/3 HCl). The sample contains a small excess of CO_2 in proportion to CaO (0.043 eq/100 g) and 58.3 % $CaCO_3$ estimated from the CaO content. The remaining CO_2 quantity might be derived from $MgCO_3$ corresponding to 1.8 % or from $FeCO_3$ corresponding to 2.5 % of the sample.

Locality and stratigraphic derivation

Well-preserved, partly articulated skeletal elements of a small bird were found in grey marl (a chemical analysis of matrix is given in tab. 1) by J. Gregor, W. Jung and A. Selmeier during an excursion on July 1, 1973, in profile AZ (pers. comm., Jung, 1973, letter) at one of the small tributary streams of the river Achenbach, half a km south of Friesing (Samerberg), Landkreis Rosenheim, Bavaria, Western Germany. The clay containing the fossil belongs to a series of lacustrine sediments which judging from their content of pollen are of Eemian age; the deposit appears to cover the complete interval from the end of the Riss glaciation to, or into, the Würm glaciation (G r ü g e r , 1972). Pollen analysis of the clay immediately surrounding the bird specimen (tab. 2) has been carried out by S. F u n d e r and shows a large dominance of conifer pollen while pollen of deciduous and herbaccous species are noticeably less frequent. The high percentage of spruce and fir is suggestive of a deposition of the specimen during the Fichten-(Tannen)-Zeit: zone 10 of the Samerberg area of Beug & Grüger (1972). This corresponds to pollen zone 8 at Grossweil of Helga Reich (1953), another locality of the Alpine foreland. It appears from the pollen diagram that the Gernmühler lake was surrounded by coniferous forest during the zone 10-time of deposition, i. e. the

T a b l e 2. Pollen analysis of matrix close to the *Porzana porzana* remains:

	Number	Percent
Pinus	25	3.0
Picea	588	70.8
Abies	148	17.8
Carpinus	4	0.5
Quercus	3	0.4
Tilia	2	0.2
Ulmus	2	0.2
Acer	2	0.2
Mixed oak forest (QM = EMW)		1.0
Alnus	12	1.4
Betula	17	2.0
Corylus	12	1.4
Ilex	1	0.1
Tree pollen (AP = BP)		97.5
Gramineae	13	1.6
Polypodiae	12	1.4
Pteridium	1	0.1
Non-tree pollen (NAP = NBP)		3.1
TOTAL	838	100.8

time of the bird under investigation. According to Reich (op. cit.) the second part of the Eemian interglacial, from (and including) zone 8, which was characterized by coniferous forests, was a cool temperate period („wesentlich kälter als jetzt", Reich, 1953, p. 426), while Dehm & Jung (1972, p. 130,) assume no important deterioration of the interglacial climate during the „Tannenzeit", which follows after the interglacial climatic optimum. The great frequency of *Abies* in the pollen zone to which the bird belongs may be explained as due to a rise in humidity. A further reason for the expansion of the conifers may be sought in progressive soil leaching of the area (cf. Andersen, 1969).

Description and taxonomy of the specimen

The fossil material comprises a laterally compressed shoulder girdle, consisting of the sternum (s t , pl. 1, fig. 1) somewhat broken and devoid of the anteriormost part with the articulations for the coracoids and the ribs, the furcula (f u , pl. 1, fig. 1) which is fragmented, the coracoids (l. c o and r. c o , pl. 1, fig. 1) in an incomplete state, and the scapulae (l. s c and r. s c , pl. 1, fig. 1) lacking their proximal parts; a left and a right humerus (l. h u and r. h u , pl. 1, figs. 1 and 2) of which the left one is lacking its distal end and part of the proximal end of the shaft; parts of four ventral rib segments (v c. r, pl. 1, fig. 1); the proximal part of a right dorsal rib segment (r. d o. r, pl. 1, fig. 1); and, finally, two nearly complete heterocoelous vertebrae (v_{13} and v_{14}, pl. 1, fig. 1 and text fig. 2).

As is obvious from their size range, their mutual location, and the similar state of preservation of the bones all these skeletal elements pertain to a single individual. No other avian remains, it can be added, have so far been found in the rather well investigated deposits. The bones are preserved on a small slab of dried, macroscopically unstratified, grey clay with a discernible bitumen content (see matrix on pl. 1, fig. 1). All of the preserved bones have suffered some fragmentation during compaction of the sediment.

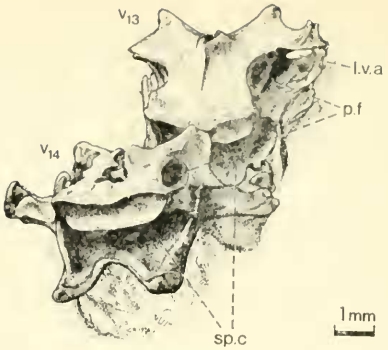
It appears from the interrelationship of the bones on the slab that the elements of the shoulder girdle, the humeri and the distal rib segments were in their original articulation when deposited. Likewise, the morphology and interrelation of the two vertebrae, which are found situated about 3 cm from the ventral side of the shoulder girdle (see pl. 1, fig. 1), indicate an unbroken original interarticulation, though isolation from the other skeletal parts, during embedding. The presence and location of these two bones, as well as those of the single proximal rib segment found on the slab about 1 cm posterior to the scapulae (see pl. 1, fig. 1), may suggest that the bird's carcass was more complete when it settled on the bottom of the lake. Bottom scavengers may have contributed to the spreading and perhaps removal of various parts which had not become lost during the time of flotation of the dead bird on the water surface. This prozess can, incidentally, last for a very long time as has been demonstrated by U. Mohl (pers. comm., 1974) for, among other animals, a dead coot, *Fulica atra*, which floated during more than two months on a fresh water lake before submerging. Certain fragments originally belonging to the fossil specimen, as e. g. the missing parts of the left humerus, have most probably been lost during uncovering of the specimen.

The sternum, although devoid of the anterior part, is sufficiently morphologically distinctive for referring the specimen to the Rallidae: a narrow, posteriorly

pointed sternal plate, laterally flanked by deep emarginations which from behind separate the median xiphoid process from the long and backwards pointing, single lateral xiphoid processes, evidences affinity to the rail family. The mentioned features, in combination with a well developed carina which shows a clear, ovaloid impression of musculus supracoracoideus (i. m. s, pl. 1, fig. 1) taking up about half of the carinal lateral surface, are characteristics of the good flyers among the Rallidae. The specimen even shows in its sternum a number of features that clearly reveal its affiliation to the genus *Porzana*. The most important of these features may briefly be summarized as follows: (1) The concentration anteriorly of the articular facets for the ribs which is evidenced by the slope of the visible part of the left lateral margin of the sternum though no costal borders can actually be seen on the specimen; the effect of these features is that the concave carinal front edge is located comparatively far back relative to the position occupied by the costal borders; (2) The long and narrow V-shaped posterior emarginations of the sternal plate; (3) The carina being comparatively higher than that of other rails (excluding here for obvious reasons the more exotic members of the 130—150 known species of Recent and fossil rails).

Having now on the basis of the sternum referred the present specimen to the genus *Porzana* it remains to be stated that judging from its size in combination with the above mentioned skeletal characteristics only one species among known

Text fig. 1: Outline of spotted crake, *Porzana porzana,* with the preserved skeletal parts sketched in. Total length of the bird, from point of the beak to termination of the tail-feathers (when the bird lies flat on its back), is 23 cm.



Text fig. 2: Cervical vertebrae nos. thirteen (v_{13}) and fourteen (v_{14}) of *Porzana porzana* from the Eemian marl deposit of Friesing (Samerberg), Bavaria. The vertebrae, which are exposed upside down, are seen from behind. l. v. a left vertebral artery canal; p. f pneumatic foramen; sp. c spinal canal.

Recent and fossil rails can be considered the one to which the fossil discussed here belongs, namely *Porzana porzana* (L.), the spotted crake (text fig. 1).

Of the remaining skeletal elements shown by the specimen none has features that suggest another specific affinity than that demonstrated by the sternum. They all fit into the morphological pattern typical of rails and also of *Porzana porzana* and need no futher taxonomic consideration.

The two vertebrae (v_{13} and v_{14}, text fig. 2, and pl. 1, fig. 1) which are situated at some distance from the bones of the shoulder girdle on the clay slab, correspond to the two hindmost cervical vertebrae of the living *Porzana porzana*, these being numbers 13 and 14 of the vertebral column. They have their ventral surface exposed. Both are somewhat compressed and fragmented causing a breakage of the lateral walls and partial collapse of the spinal canal (s p. c, text fig. 2). Also the hypapophyses are lacking in the present specimen. In v_{13} the left canal for the vertebral artery (l. v. a) is intact, while no lateral wall (which is formed by the fused rib element) of the right vertebral artery canal has been preserved. Vertebra no. 14 in *Porzana porzana* is characterized by having free cervial ribs, a feature of the posterior cervical vertebra(e) not uncommon in birds. The right and left regions of rib-articulation of v_{14} have been somewhat injured but show clear similarity to the same regions in living spotted crakes. Both fossil vertebrae were pneumatized as are the corresponding ones in the Recent form; this is indicated by the conspicuous foramina clearly seen on the lateral walls of the vertebral bodies on the specimen (p. f, text fig. 2).

Discussion

The morphology of the fossil specimen under discussion, and the fact that the age of the fossil does not surpass 150.000 years (the approximate time span elapsed since the end of the Riss glaciation [Cooke, 1973]) renders it probable that this Eemian bird can be included in the extant species *Porzana porzana*. With this age consideration in mind, it may be of interest to investigate how far back in time it is actually possible to trace the spotted crake species.

Ornithologists usually agree that living rails, although having a great variety of habitats and a world-wide distribution, show comparatively little variation in their skeletal morphology. The rail-type, when taken in a broad sense as an average of the morphology of undisputed rails, seems to be of very great antiquity. This is indicated by tibiotarsi of birds referable to the Rallidae from North American deposits of Wasatchian age (Cracraft, 1973), and by a Lower Eocene bird cranium from North Sea deposits which is unmistakeably ralliform in all traceable details (Hoch, 1974). Rail fossils are relatively numerous in younger Cainozoic strata (: above Lower Eocene), and it can be reasonably assumed that the Rallidae originated during Cretaceous times (the Upper Cretaceous *Telmatornis* spp. are referred to the Rallidae, Brodkorb, 1967). The relative abundance of fossil and subfossil rail remains may be explained by : the preference of many rail species for habitats of high fossilization-potential; a great species-diversity and number of individuals; and a cosmopolitan nature of the group since early bird history. Thus the Rallidae might appear one of the better suited avian groups for judging longevity of birds species.

Various authors have investigated the problem of bird species longevity. Recently Harrison (1973), reviewing part of the relevant literature, quoted Brodkorb (1971) who suggests a mean longevity of the order of half a million years for Pleistocene bird species, and about three million years for bird species of the climatologically more stable Tertiary period. Brodkorb is probably right in suggesting a **difference** in mean species longevity between Pleistocene species on one hand and those of the pre-Pleistocene periods on the other. But the time-duration involved still seems open to discussion. It appears true, however, that most (Brodkorb [1971] proposes: all) Recent bird species have resulted from Quaternary speciation.

Consulting published information it is evident that, as far as concerns rail speciation, the material at hand, although plentiful, is still insufficient for reliable statements concerning the approximate longevity of any known species. In the case of *Porzana porzana* Brodkorb's Catalogue of Fossil Birds (1967) registers 14 localities, all of Pleistocene age. Each locality has yielded one or a few skeletal parts of the species. It should, however, be emphasized that the bird remains from 12 of these localities were taxonomically described before 1933 (the year of publication of Lambrecht's Palaeornithologie), and although the specific determinations may be adequate (see also Moreau's appropriate reservations [1954, p. 420]), the correct stratigraphical locations of the various remains within the Pleistocene were poorly studied at that time.

In those days palaeontologists apparently attached little importance to the stratigraphical subdivision of Pleistocene deposits, which resulted in the mere age-statement of „Pleistocene" for the above mentioned fossil birds. The reason may be sought for in the fact that apparently all of the early found *Porzana porzana* fossils were derived from caves, where the deposits have often been more or less disarranged by the later actions of man, animals or water. On the other hand, the disarrangement of the chronological succession may not have occurred until the moment of the so-called scientific excavation of the caves, at that time a fairly picturesque undertaking.

As regards the registered *Porzana porzana* remains, only the two newcomers in Brodkorb's list of *Porzana porzana* finds: humerus sinistra, Istállóskö in Hun-

gary (JÁNOSSY, 1954), and humerus and tarsometatarsus, Kebara Cave in Palestine (TCHERNOV, 1962) are referred to stages of the Pleistocene, namely to the Würm I—II interstadial and the Würm stage respectively.

For the time being, therefore, we may conclude that *Porzana porzana* is restricted to post-Pliocene deposits. The species is presumably not older than Lower, or perhaps Middle, Pleistocene.

Judging from the distribution of Pleistocene localities yielding *Porzana porzana,* in Monaco, Italy, Switzerland, Czechoslovakia, Poland, Hungary, Palestine (BRODKORB, 1967) and Bavaria (the specimen described here), the Pleistocene geographical range of the species may not have exceeded the present one. At present the breeding range is the Western Palaearctic covering most of Europe (excluding Portugal, south Italy and the south Balkans) and western Asia to about 60° N. and as far east as the Yenisei (for details see VAURIE, 1965). The Quaternary of Europe is regarded as a period of extreme climatic and biological fluctuations, and it could be suspected that the breeding range of spotted crakes oscillated northwards and southwards during that period following certain temperature regimes. The biology of living spotted crakes shows, however, that temperature itself is of less importance for the distribution of the species than is a particular vegetation type which may occur in various climatic realms: „shallow swamps, bogs and very wet meadows, especially where overgrown with sedges *(Carex),* and swampy edges of ponds, lakes, and rivers with similar vegetation" (VAURIE, 1965, p. 347). Using the words of MEINERTZHAGEN (1954, p. 560) the bird behaves here as „an inveterate skulker, seldom seen in the open . . . a silent bird except in the breeding season". MOREAU's (1954, pp. 428—429) statement that „for most land-birds the post-Pliocene history has been a series of compressions and expansions (the present writer's accentuation) of range on an enormous scale" seems to illustrate the distribution of spotted crakes during the glaciations and interglaciations. MOREAU (1954, p. 417 below, f) even gives a description of an environment which in west and central Europe during a glaciation period could fulfil the ecological requirements of spotted crakes. Caves were here very important habitats and this may explain the presence of scattered *Porzana porzana* remains among the bone fragments on (and in) the cave floors.

In addition to the *Porzana porzana* specimen described in the present paper one other find of this rail species has been reported from Western Germany, namely a left femur from the large collection of bones recovered from lake sediments of late glacial (pre-Allerod) age at the locality of Meiendorf, northeast of Hamburg (KRAUSE, 1937; KRAUSE & KOLLAU, 1943). Apparently the bones from this locality represent household refuse dumped into the lake by nomadic reindeer hunters who had their summer settlement somewhere at the lake shore close to the excavation locality. This *Porzana porzana* specimen deserves some comments.

LOPPENTHIN (1967) expressed doubt on the presence of spotted crakes in the fauna of a typical tundra environment such as that apparently prevailing at the time of the Meiendorf settlement. He was considering that problem in relation to a study of Danish Pleistocene and Holocene bird material among which no remains of the spotted crake have appeared so far. Loppenthin had other reasons to doubt this find. Allegedly the femur was compared by Dr. Krause (KOLLAU in KRAUSE & KOLLAU, 1943, p. 53) to Recent material of the spotted crake kept in the collection of the Zoological Museum in Copenhagen. But enquiries among relevant

persons in that museum revealed that none of the staff remembers Dr. Krause's visit or his case. Enquiries at the Gottorp Castle where the collection from Meiendorf is stored, stateably in toto, also gave no positive evidence, but revealed the astonishing fact that the specimen could not be refound. Impressed by this negative evidence, Loppenthin concluded that *Porzana porzana* could hardly be a member of the Meiendorf fauna, and its presence, if true, in the Meiendorf collection might well have been due to mixing of that material with subfossil bones from younger strata.

Disregarding these uncertainties, it is a fact that *Porzana porzana* is a highly migratory species crossing even the Sahara to and from its winter quarters located in, among other places, trans-Saharan Africa (Heim de Balsac & Mayaud, 1962; Moreau, 1967). It is also reported as far north as Greenland (Ulfstrand, 1961, p. 278). In the writer's opinion, therefore, there are no good reasons to assume that *Porzana porzana* could not have lived around the Meiendorf Moor in late glacial summers, although perhaps not in a breeding population. However, possibility of the presence of stray specimens should not be discounted.

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Plate Explanation

Plate 1

Fig. 1. *Porzana porzana* (L.), Eemian marl deposit of Friesing (Samerberg), Bavaria. Nr. 1973 I 59, Bayerische Staatssammlung für Paläontologie und historische Geologie, München. fu furcula; l.co left coracoid: l.hu left humerus; l.sc left scapula; r.co right coracoid; r.do.r right dorsal rib segment; r.hu right humerus; r.sc right scapula; st sternum; v_{13} cervical vertebra no. 13; v_{14} cervical vertebra no. 14; ve.r ventral rib segment.

Fig. 2. Right humerus (r.hu) of the same specimen as in fig. 1. Length of fossil, from extreme proximal point of caput articulare (cf. Lambrecht, 1933) to extreme distal point of trochlea ulnaris (cf. Lambrecht, 1933), is 35.1 mm.

Preparation of the specimen by E. Schmieja, Bayer. Staatssammlung für Paläontologie und historische Geologie, München.